Calibration of Interferometric SAR System using Kinematic Ground GPS Measurements

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The calibration of Interferometric SAR (IFSAR) systems based on using corner reflectors as ground control points, for missions that are extended over long time periods, or for global coverage missions like the forthcoming NASA/NIMA Shuttle Radar Topography Mission (SRTM), is not feasible due to cost or deployment constraints. in this paper, we present an alternate technique, based on the use of GPS surveys, which can be acquired at low cost over extended areas. The GPS measurements along radar identifiable features may be acquired and archived prior to any data collection and then used independently or in conjunction with other ground control data, such as known ocean surface elevation, in system calibration.

In this paper, we present an algorithm for the automated matching of the three-dimensional curve defined by the GPS transect measurements to its corresponding feature in the radar image and IFSAR derived height map. The est i mated shift is fed back to a tuning algorithm in which system parameters are updated. This process may be iterated until convergence to the IFSAR calibration parameters is achieved. Unlike corner reflectors which are extremely compact and bright, roads are wide and often not easily distinguishable from their background. The lack of a strong contrast between the road and the background in the radar image and its variable width pose the main difficulties that need to be overcome. We present a technique to detect a road based on its statistical differences from its background, and discuss the issues related to the robustness of the technique and its limitations. As a practical demonstration, we present results for the calibration of the JPL TOPSAR system, as well as simulated results analyzing the expected performance for the forthcoming SRTM instrument.